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Notes:

1. Untranslatable words are replaced with asterisks (***)�.
2. Texts in the figures are not translated and shown as it is.

Translated: 22:44:45 JST 10/21/2008

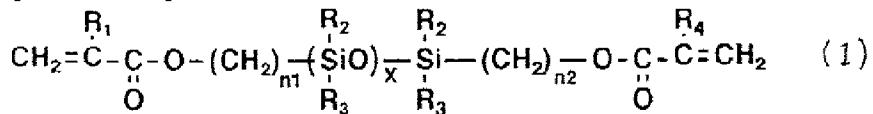
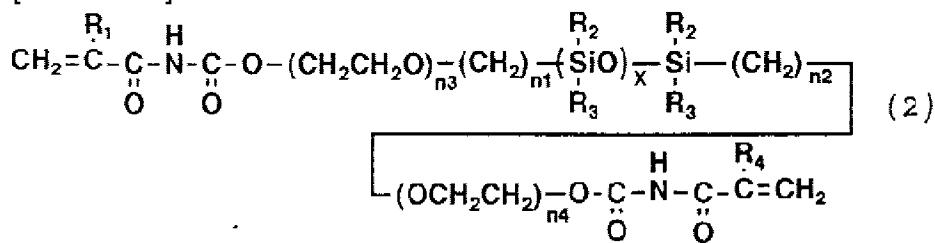
Dictionary: Last updated 10/08/2008 / Priority: 1. Chemistry

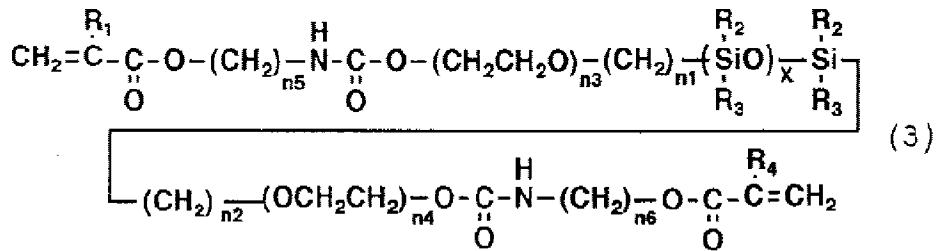
CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] Ophthalmic lens material which consists of a copolymer which consists of a silicon content styrene system monomer which the silicon atom combined with silicone system macromere, the fluorine content monomer, and the ring through other atoms other than a direct or silicon atom.

[Claim 2] Ophthalmic lens material according to claim 1 characterized by silicone system macromere being at least a kind of compound chosen from the compound shown by the following type (1), (2), or (3).

[Formula 1]**[Formula 2]****[Formula 3]**



R_1, R_4 : それぞれ水素またはメチル基。

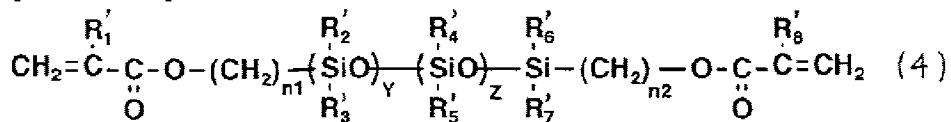
R_2, R_3 : それぞれ炭素数 1 ~ 12 のアルキル基またはトリメチルシリキシ基。

n_1, n_2, n_5, n_6 : それぞれ 1 ~ 20 の整数。

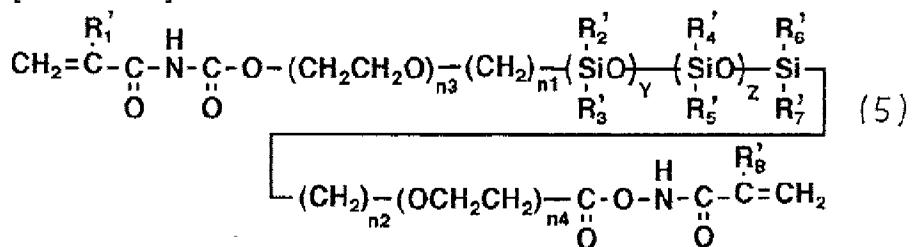
n_3, n_4 : それぞれ 0 ~ 20 の整数。

[Claim 3] Ophthalmic lens material according to claim 1 or 2 characterized by silicone system macromere being at least a kind of compound chosen from the compound shown by the following type (4), (5), or (6).

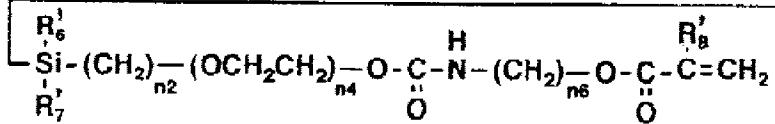
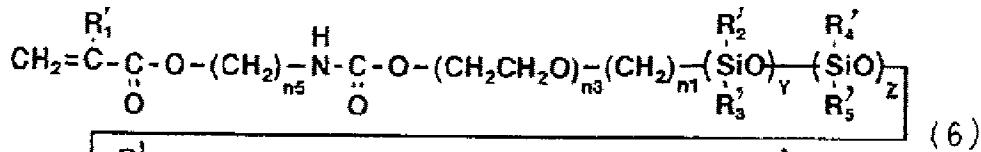
[Formula 4]



[Formula 5]



[Formula 6]



R'_1, R'_8 : それぞれ水素またはメチル基。

$\text{R}'_2, \text{R}'_3, \text{R}'_6, \text{R}'_7$: それぞれ炭素数1～12のアルキル基またはトリメチルシリキシ基。

R'_4, R'_5 : それぞれ炭素数1～12のアルキル基またはトリメチルシリキシ基であり、その一部がフッ素原子で置換されているてもよい。

$n1, n2, n5, n6$: それぞれ1～20の整数。

$n3, n4$: それぞれ0～20の整数。

Y, Z : $0.01 \leq Z / Y \leq 1$ を満たす整数。

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to ophthalmic lens material. It is related with ophthalmic lenses, such as a contact lens, an intraocular lens, etc. which are transparent, and have high oxygen permeability and chemical resistance in more detail, and were excellent in shock resistance, and the ophthalmic lens material which can especially carry out suitable to a contact lens.

[0002]

[Description of the Prior Art] As the charge of hard contact lens material from the former, Since it had outstanding optical characteristics, polymethylmethacrylate was used, but there was almost no oxygen permeability of the material itself, and when oxygen required for the metabolic turnover of a cornea was not fully able to be supplied but was worn for a long time, there was a problem of causing the metabolic defect of cornea tissue. Then, in order to solve such a fault, the siloxanyl methacrylate which was excellent in oxygen permeability as a contact lens, fluoro alkyl methacrylate, and the thing which consists of the copolymer are used briskly today. While carrying out a deer It is in the tendency for hardness, such as shock resistance, to fall when material which consists of these silicone system monomer or a fluorine system monomer is used as a contact lens. When a user uses a contact lens, indication of becoming easy to produce breakage etc. is made (NIKKEI NEWMATERIALS P.57 1991/9/23).

[0003] It is hard lens material as a general tendency, It adds to the fall of hardness which said

previously that the component of a silicone system is increased in order to raise oxygen permeability. In order for material hardness to fall, the cutting / polish workability also falls, and in order to raise hardness and lens workability conversely, when it is going to add other copolymerization components, there is a problem that it becomes difficult to secure sufficient oxygen permeability. The lens materials which used maleate and fumaric acid ester as the copolymerization component until now, for example in order to solve such a problem (JP,S63-11908,A, JP,S63-132216,A, etc.), the material (JP,H4-227616,A --) which consists of a silicone content acrylic block copolymer 3 organic-functions isocyanate, such as JP,H4-249508,A, and the poly dimethylsiloxane which has active hydrogen, The copolymer material which consists of the monomer which has a polymerization nature double bond (JP,H3-2283,B etc.), The copolymerization things (JP,60-142324,A No. news, the JP,H2-198415,A news, JP,4-120110,A, the JP,H4-168415,A news, the JP,H4-264421,A news, JP,H5-45614,A news, etc.) which consist of the silicone system monomer which has a styrene frame are developed.

[0004] On the other hand, the ophthalmic lens also has the whole surface easily influenced by environment, for example, the user of a contact lens may be influenced by cosmetics, although the woman has a large number. Furthermore, it may also happen un-arranging of being unable to use applying-eyewash liquid, while the patient who cannot but use eye drops had carried the lens. However, the present condition is that development of the ophthalmic lens material which the example of research to which the design of the lens material was positively carried out from a viewpoint of chemical resistance until now does not have, and fulfills all the conditions, such as hardness, workability, oxygen permeability, and chemical resistance, and is excellent in transparency is desired.

[0005]

[Problem(s) to be Solved by the Invention] In view of said conventional technology, this invention is transparent, and oxygen permeability, shock resistance, and its workability are good, and it aims at offer of ophthalmic lens material excellent in chemical resistance.

[0006]

[Means for Solving the Problem] This invention persons need to mind [silicone system macromere, a fluorine content monomer, and] other atoms other than a direct or silicon atom, as a result of inquiring wholeheartedly that the above-mentioned target should be attained. By using the silicon content styrene system monomer which the silicon atom combined, it succeeds in development of the material with which it may be simultaneously satisfied of hardness, oxygen permeability, workability, and any chemical-resistant physical properties, and came to complete this invention.

[0007] That is, this invention is an ophthalmic lens material which consists of a copolymer which consists of a silicon content styrene system monomer which the silicon atom combined with silicone system macromere, the fluorine content monomer, and the ring through other

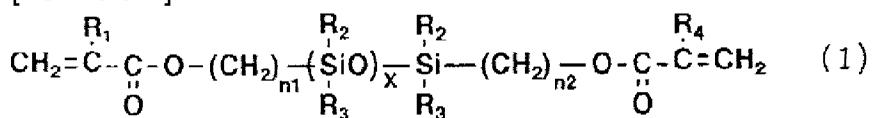
atoms other than a direct or silicon atom. This invention is explained in detail below.

[0008] Mind [silicone system macromere, a fluorine content monomer, and] other atoms other than a direct or silicon atom. The copolymer which uses as an essential ingredient the silicon content styrene system monomer which the silicon atom combined has comparatively high oxygen permeability. After having hardness still more nearly required for transparency and cutting / polish processing, and having a moderate medicine-proof, and processing it to a lens, for example, being immersed to an ethanol aqueous solution 40%, good image formation can be obtained by being stabilized.

[0009] The silicone system macromere used for this invention gives high oxygen permeability and shock resistance to a copolymer. As silicone system macromere, an acrylic acid machine, an methacrylic acid radical, Although 700 or more things are mentioned including the polymerization nature machine represented by the vinyl group as a styrene conversion number average molecular weight at the time of the molecular weight of a substantial silicone chain analyzing using gel permeation chromatograph (GPC) In order to fully reduction-ize the leached moiety from a polymerization constituent and to secure the moderate hardness for processing, the macromere which consists of the structure shown by general formula (1) - (6) which has a polymerization nature machine to the both ends of a silicone chain is desirable.

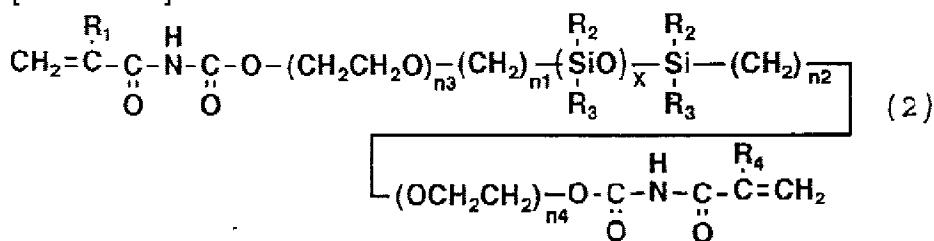
[0010]

[Formula 7]



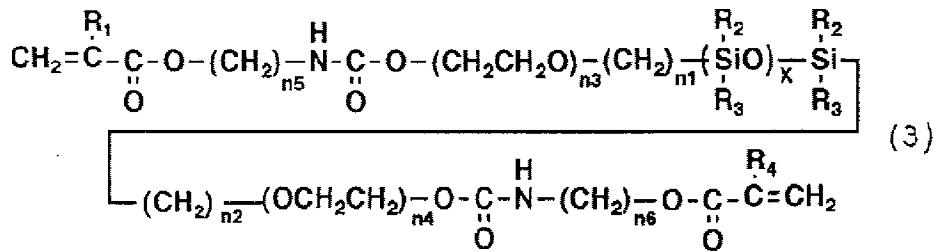
[0011]

[Formula 8]



[0012]

[Formula 9]



R_1, R_4 : それぞれ水素またはメチル基。

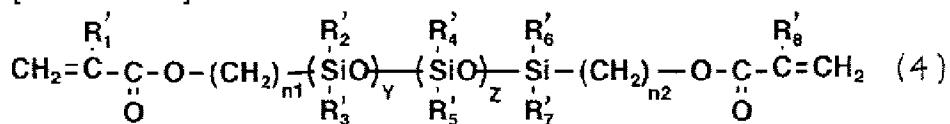
R_2, R_3 : それぞれ炭素数 1 ~ 12 のアルキル基または
トリメチルシリキシ基。

n_1, n_2, n_5, n_6 : それぞれ 1 ~ 20 の整数。

n_3, n_4 : それぞれ 0 ~ 20 の整数。

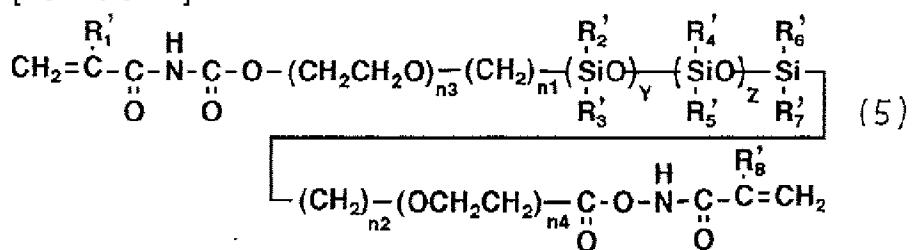
[0013]

[Formula 10]



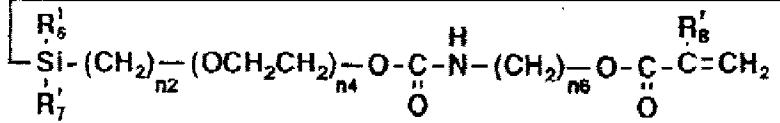
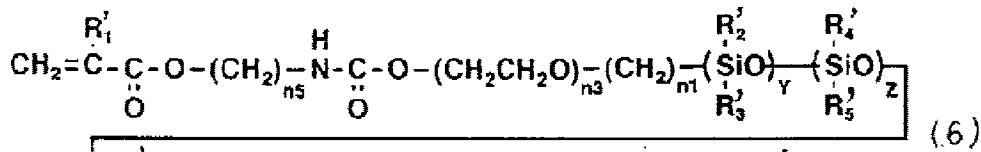
[0014]

[Formula 11]



[0015]

[Formula 12]



R'_1, R'_8 : それぞれ水素またはメチル基。

$\text{R}'_2, \text{R}'_3, \text{R}'_6, \text{R}'_7$: それぞれ炭素数 1 ~ 12 のアルキル基またはトリメチルシリキシ基。

R'_4, R'_5 : それぞれ炭素数 1 ~ 12 のアルキル基またはトリメチルシリキシ基であり、その一部がフッ素原子で置換されているてもよい。

n_1, n_2, n_5, n_6 : それぞれ 1 ~ 20 の整数。

n_3, n_4 : それぞれ 0 ~ 20 の整数。

Y, Z : $0.01 \leq Z/Y \leq 1$ を満たす整数。

[0016] Moreover, as for the molecular weight of silicone system macromere, it is desirable that it is in the range of 1000-10000, and it is 2500-5000 more preferably. If it is this range, physical properties, such as oxygen permeability, hardness, workability, and transparency, are better. In addition, this molecular weight of silicone system macromere is a styrene conversion number average molecular weight calculated by analyzing the substance which hydrolyzes the ester bond included in a polymer using an acid etc., and is extracted with organic solvents, such as chloroform, using GPC. Moreover, it is possible by isolating the fraction preparatively and conducting mass analysis (MS), infrared spectroscopic analysis (IR), a nuclear-magnetic-resonance-analysis (NMR) ultimate analysis, etc. to specify a chemical constitution.

[0017] The inside of general formula (1) - (3), R_1 , and R_4 are the alkyl groups or trimethylsiloxy machines of carbon numbers 1-12, and hydrogen or a methyl group, R_2 , and R_3 are n_1 , n_2 , and n_5 , respectively. And n_6 is the integer of 1 [same or different]-20 [same or different], respectively, and n_3 and n_4 are the integers of 0 [same or different]-20 [same or different], respectively. the inside of general formula (4) - (6), R'_1 , and R'_8 -- ' -- respectively -- hydrogen or a methyl group -- Even if R'_2 , R'_3 , R'_4 , R'_5 , R'_6 , and R'_7 are the alkyl groups or trimethylsiloxy machines of carbon numbers 1-12, respectively and a part of R'_4 or R'_5 is replaced by the fluorine atom It is good. It is expectable to have the character to be easy to separate even if it has the effect which controls that a material list side is polluted by protein in tear fluid, a lipid, the mineral constituent, etc. and a pollutant adheres by fluorine displacement. For example, 3, 3, and 3-trifluoro propyl group, 1, 1 and 2, a 2-tetrahydro perfluoro octyl group, 1, 1 and 2, a 2-tetrahydro perfluoro decyl group, etc. are mentioned, and a trifluoro propyl group is especially desirable. Y and Z It is the integer with which $0.01 \leq Z/Y \leq 1$ is filled. Since

compatibility will worsen if 0.5 is exceeded, as for Z/Y, it is desirable that it is 0.5 or less. n1, n2, n5, and n6 are the integers of 1 [same or different]-20 [same or different], respectively, and n3 and n4 are the integers of 0 [same or different]-20 [same or different], respectively. [0018] As for the quantity contained in the copolymer of a silicone system macromere unit, it is desirable that it is in 5 to 60% of range to the copolymer whole quantity as a value which carried out weight conversion, and it is desirable that it is in further 10 to 40% of range. One sort of these silicone system macromere may be used, two or more sorts may be combined and it may be used.

[0019] As an example of the fluorine content monomer used in this invention, methacrylic acid fluoro alkyl ester, acrylic acid fluoro alkyl ester, and a fluorine content aromatic series monomer can be mentioned. The unit of these monomer origin can have the character of water-repellent ** oil repellency due to the fall of the critical surface tension which originates in a fluorine atom while giving hardness, and this can suppress that the contact lens surface is polluted by components, such as protein in tear fluid, and a lipid.

[0020] As the example of the above-mentioned methacrylic acid fluoro alkyl ester and acrylic acid fluoro alkyl ester, Trifluoroethylmethacrylate, tetrafluoro ethyl methacrylate, Tetrafluoro propyl methacrylate, pentafluoro propyl methacrylate, Hexafluoro butyl methacrylate, hexafluoro isopropyl methacrylate, Heptafluoro butyl methacrylate, octafluoropentyl methacrylate, Nona fluoro pentyl methacrylate, dodeca fluoro pentyl methacrylate, Dodeca fluoro heptyl methacrylate, dodeca fluoro octyl methacrylate, It is mentioned by the acrylate corresponding to trideca fluoro heptyl methacrylate and these methacrylate, and as an example of a fluorine content aromatic series monomer Fluorine content styrene derivatives, such as fluoro styrene, trifluoro methyl styrene, and pentafluoroethyl styrene, etc. are mentioned, and they are trifluoroethylmethacrylate, hexafluoro isopropyl methacrylate, and freak fluoro pentyl methacrylate preferably, Dodeca fluoro octyl methacrylate And the acrylate corresponding to these methacrylate is used and trifluoroethylmethacrylate, trifluoroethyl acrylate, hexafluoro isopropyl methacrylate, and hexafluoro isopropyl acrylate are used still more preferably. One sort of these monomers may be used, two or more sorts may be combined and they may be used.

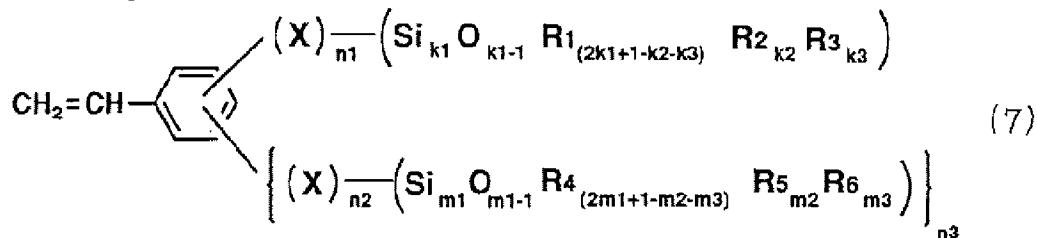
[0021] As for the quantity contained in the copolymer of a fluorine content monomer, it is desirable that it is in 10 to 90% of range to the copolymer whole quantity as a value which carried out weight conversion, and it is desirable that it is in further 40 to 80% of range. About the fluorine content monomer used by this invention The combination which added the gas chromatograph to a pyrolysis gas chromatograph, a pyrolysis gas chromatograph, the combination of mass analysis and a pyrolysis gravimetric analysis, mass analysis, and this, For example, the multiple analysis of other general-purpose analytical skills, such as a ultimate analysis, X-ray fluorescence, and a nuclear magnetic resonance spectrum, can analyze.

[0022] Moreover, mind [which is used by this invention] other atoms other than a direct or silicon atom. [the silicon content styrene system monomer which the silicon atom combined] Generally the compatibility of silicone system macromere, and an acrylic ester, the monomer of a methacrylic ester system and a hydrophilic monomer with bad compatibility is raised, and there is an effect which makes possible copolymerization with the monomer which gives hardness, holding high oxygen permeability, without becoming cloudy.

[0023] Here, as other atoms other than a silicon atom, an oxygen atom, a sulfur atom, a nitrogen atom, etc. can be mentioned, and an oxygen atom and a sulfur atom are especially desirable. As a silicon content styrene system monomer which the silicon atom combined with the ring used by this invention through other atoms other than a direct or silicon atom, the silicon content styrene system monomer shown by the following formula (7) can be mentioned, for example.

[0024]

[Formula 13]



X:O またはS

R₁, R₂, R₃, R₄, R₅, R₆: それぞれアルキル基、フルオロアルキル基、ヒドロキシアルキシ基、アルコキシ基、ヒドロキシアルコキシ基、フェニル基、ベンジル基またはヒドロキシル基

n1,n2: 0 または 1

n3: 0, 1 または 2

k1,m1: 1 ~ 10 の整数

k_2, k_3 : k_2+k_3 が0から $2k_1$ 以下の整数

m_2, m_3 : m_2+m_3 が0から $2m_1$ 以下の整数

[0025] As the example of a general formula (7) **, trimethylsilyl styrene, trimethylsiloxy styrene, dimethylsilyl (methoxy) styrene, Dimethylsilyl styrene, dimethyl (trimethylsiloxy) siloxy styrene, (Trimethylsiloxy) Bis(trimethylsiloxy) methyl silyl styrene, bis(trimethylsiloxy) methyl siloxy styrene, Bird (trimethylsiloxy) silyl styrene, bird (trimethylsiloxy) siloxy styrene, [JI (trimethylsiloxy) methyl siloxy] Dimethylsilyl styrene, [Bird (trimethylsiloxy) siloxy] Dimethylsilyl styrene, Trideca MECHIRUHEKISA siloxanyl styrene, PENTADEKAMECHIRU hepta-siloxanyl

styrene, Heptadeca MECHIRUOKUTA siloxanyl styrene, nonadeca MECHIRUNONA siloxanyl styrene, and all these all [a part or] An ethyl group, It is from the stability of a monomer or a copolymer being [in which the silicon content styrene system monomer which are an alkyl group, a fluoro alkyl group, a hydroxyalkyl machine, a phenyl group, benzyl, hydroxyls, etc., such as tert-butyl, is mentioned] good, The silicon content styrene system monomer which the direct silicon atom combined with the ring is used, and the silicon content styrene system monomer which the direct silicon atom combined with six or less rings in the silicon atomic number contained is used still more preferably.

[0026] One sort of these monomers may be used, two or more sorts may be combined and they may be used. As for the quantity contained in the copolymer of the silicon content styrene system monomer which the silicon atom combined with the ring through other atoms other than a direct or silicon atom, it is desirable that it is 1 to 80% to the copolymer whole quantity as a value which carried out weight conversion, and it is desirable that it is in further 3 to 50% of range. Mind [this] other atoms other than a direct or silicon atom. When there is less content of the silicon content styrene system monomer which the silicon atom combined than the first half range, When it falls, or the workability from which the mechanical hardness of the ophthalmic lens material obtained is not obtained enough may become cloudy and exceeds the first half range, it is also possible that sufficient machine hardness is not obtained.

[0027] The silicon content styrene system monomer which the silicon atom combined with the ring used by this invention through other atoms other than a direct or silicon atom can be analyzed by the same method as the above-mentioned fluorine content monomer. In addition, the ophthalmic lens material which consists of a copolymer of this invention is desirable, and the oxygen permeability is more than 50 (10-11cm³, cm/cm², and sec-mmHg) more preferably 40 or more. Oxygen permeability here is a value which is measured by the method shown in the work example in this Description, and is acquired.

[0028] Moreover, in the falling weight test shown in this Description work example about machine hardness, it is desirable that the drop height at the time of breakage is 40cm or more, and it is 45cm or more more preferably. Moreover, copolymerization of other copolymerization components can be carried out to the copolymer used by this invention besides the silicon content styrene system monomer which the silicon atom combined with silicone system macromere, an above-mentioned fluorine content monomer, and an above-mentioned ring through other atoms other than a direct or silicon atom. In addition, it is possible to analyze by the same method as the above-mentioned fluorine content monomer about the copolymerizable monomer contained in a copolymer.

[0029] They are these monomers although alkyl methacrylate ester and acrylic acid alkyl ester can be mentioned as an example of a copolymerizable monomer, Silicone system macromere, a fluorine content monomer, the silicon content styrene system monomer that the silicon atom

combined with the ring through other atoms other than a direct or silicon atom, etc., In the limitation which is inexpensive as compared with other copolymerization components, and does not spoil the physical properties of a copolymer, it is advantageous in cost to add these components, and improvement in machine hardness can also expect it.

[0030] As the example of these alkyl methacrylate ester and acrylic acid alkyl ester, Methyl methacrylate, ethyl methacrylate, n-propyl methacrylate, n-butyl methacrylate, tert-butyl methacrylate, isobutyl methacrylate, n-hexyl AMETAKURI rate, n-octyl methacrylate, n-heptyl methacrylate, n-nonyl methacrylate, n-DESHIRU methacrylate, isodecyl methacrylate, n-lauryl methacrylate, tridecyl methacrylate, n-dodecyl methacrylate, The acrylate corresponding to cyclopentyl methacrylate, cyclohexyl methacrylate, n-stearyl methacrylate, and these methacrylate can be mentioned, and methyl methacrylate and methyl acrylate are used preferably. One sort of these monomers may be used, two or more sorts may be combined and they may be used.

[0031] As for the quantity contained in the copolymer of alkyl methacrylate ester and an acrylic-acid-alkyl-ester unit, it is desirable that it is 30% or less to the copolymer whole quantity as a value which carried out weight conversion, and it is desirable that it is 20 more%. Furthermore, in order to raise a surface wettability, the dimensional stability of a lens, a mechanical property, etc., copolymerization of the monomer described below can be carried out according to a request.

[0032] As the monomer for raising a surface wettability, For example, methacrylic acid, acrylic acid, itaconic acid, 2-hydroxyethyl methacrylate, 2-hydroxyethyl acrylate, 2-hydroxypropyl methacrylate, 2-hydroxypropyl acrylate, Glycerol methacrylate, polyethylene glycol methacrylate, N and N'-dimethyl acrylamide, N-methylacrylamide, dimethylaminoethyl methacrylate, methylene screw acrylamide, diacetone acrylamide, N-vinyl pyrrolidone, etc. are mentioned.

[0033] As for the quantity contained in the copolymer of these hydrophilicity monomeric unit, it is desirable that it is in 0.05 to 20% of range to the copolymer whole quantity as a value which carried out weight conversion, and it is desirable that it is in further 0.5 to 10% of range. As the monomer for raising the dimensional stability of a lens, For example, ethylene glycol dimethacrylate, diethylene glycol dimethacrylate, Triethylene glycol dimethacrylate, tetraethylene glycol dimethacrylate, Polyethylene glycol dimethacrylate, trimethylolpropanetrimethacrylate, Pentaerythritol tetra-methacrylate, bisphenol A dimethacrylate, vinyl methacrylate, acrylic methacrylate and the acrylate corresponding to these methacrylate, divinylbenzene, triallyl isocyanurate, etc. are mentioned. One sort of these monomers may be used and they may be used combining two or more sorts.

[0034] As for the quantity contained in the copolymer of the above-mentioned polyfunctional monomeric unit, it is desirable that it is in 0.05 to 15% of range to the copolymer whole quantity

as a value which carried out weight conversion, and it is desirable that it is in further 0.5 to 10% of range. As a monomer for raising a mechanical property, aromatic vinyl compounds, such as styrene, tert-butyl styrene, 2-methyl styrene, and 4-methyl styrene, etc. are mentioned, for example.

[0035] Moreover, in order to improve characteristics balance, such as dimensional stability, aging, etc. in the inside of the optical characteristics of an ophthalmic lens, oxygen permeability, chemical resistance, hardness, and tear fluid, it is desirable to use two or more copolymerizable monomers shown previously. The copolymer used as an ophthalmic lens material of this invention, Photopolymerization initiators, such as benzoin, benzophenone, and benzyl dimethyl beam NORU, are made to exist in a monomer mixture. It can obtain with a well-known polymerization method, such as carrying out thermal polymerization of the ultraviolet radiation using the azo compounds and organic peroxide which are glared and polymerized, such as a method or azobisisobutyronitril, benzoyl peroxide, and lauroyl peroxide.

[0036]

[Example] Next, although a work example explains this invention still in detail, this invention is not limited at all by these examples. The appraisal method of each physical properties is shown below.

- (1) According to the A method of JIS-K-7126, it measured except oxygen transmission coefficient measurement temperature having been 35 degrees C.
- (2) Best ethanol was put into the ethanol swelling rate sample bottle, and the specimen which carried out weight measurement was put in. After being immersed for one week, and taking out from the bottle, the weight of the specimen was measured 1 minute afterward exactly. Weight change of the specimen was expressed in units of percentage, and was made into the ethanol swelling rate.
- (3) 0.5mm or more was ground after cutting removal from the hardness surface, the surface was ground in the shape of a mirror plane, and hardness (Vickers hardness) was measured according to the method of JIS-Z-2244 description.
- (4) Set to a stand the sample processed with a falling ball impact test 12.6mm thickness [in diameter] of 2mm in the shape of a disk, from 15cm, begin the iron ball (7.04g) of 12 phi, drop it, and repeat until it raises height every 5cm and the same examination is destroyed, if not destroyed. The destroyed height estimated hardness.
- (5) When building the specimen for workability evaluation falling weight tests, it evaluated by cutting and grinding and processing it with a 12.6mm thickness [in diameter] of 2mm in the shape of a disk. The valuation bases of a cutting side and a polished surface are shown below.

[0037]

A: A it is [a cutting side] glossy : the gloss of a polished surface is good. Although there is gloss of B:cutting side, slightly opaque B:polish nonuniformity arises. there needs to be a C:cutting side -- ** -- there needs to be a C:polished surface which becomes white -- ** -- (6) which becomes white [the specimen which carried out chemical-resistant production / and] polish processing -- base curve: -- the lens of 8.00mm, lens center thickness:160micro, and lens power:-3D was produced, it took out after immersion and a definite period of time in the ethanol aqueous solution 40%, and change of the base curve just behind that was evaluated using the contact gauge. In addition, same evaluation was performed, using a PMMA lens as control of evaluation.

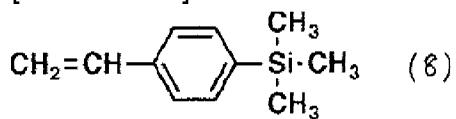
[0038]

[Work example 1] The silicon content styrene 20 weight part expressed with the following type (8) (following weight part), 30 copies of silicone system macromere expressed with the following type (9) (Mn3200), 40 copies of trifluoroethylmethacrylate (following 3FM), ten copies of methyl methacrylate (henceforth, MMA), Five copies of methacrylic acid (henceforth, MAA), five copies of ethylene glycol dimethacrylate (henceforth, ED), and one copy of benzyl dimethyl ketal were taught to the brown bottle, and dissolution mixing was agitated and carried out using the mix rotor. After deaerating mixed liquor, in nitrogen-gas-atmosphere mind, said reaction liquid was poured in into the cell which incorporated the gasket made of silicone rubber with the glass plate of two sheets put in in between, ultraviolet radiation was irradiated in this cell at the temperature of 40-50 degrees C for 1 hour, and the transparent copolymer was obtained.

[0039] Thus, about the obtained copolymer, an oxygen transmission coefficient, an ethanol swelling rate, Vickers hardness, workability, and a falling weight test were measured. A result is shown in Table 1. The contact lens was created by cutting / polish processing from the polymer furthermore obtained, and chemical resistance was evaluated. The obtained result is shown in Table 2. Although an impact portion whitens the breakage situation by the falling ball impact test of the copolymer obtained by this example and a crack enters, it does not produce that an impact spreads and a material breaks. In addition, the breakage situation of the falling ball impact test in other work examples is also extremely similar, and explanation is represented with this invention work example.

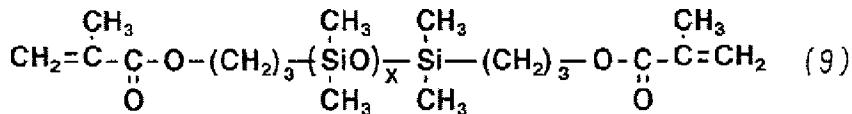
[0040]

[Formula 14]



[0041]

[Formula 15]



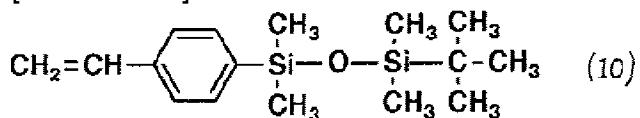
[0042]

[Work example 2] Make it be the same as that of a work example 1 except having used 20 copies of silicon content styrene expressed with the following type (10), 30 copies of silicone system macromere (Mn4000) expressed with a general formula (9), 30 copies of 3FM, 20 copies of MMA(s), five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The transparent polymer was obtained. About the obtained copolymer, the result of having measured physical properties is also shown in Table 1.

[0043] The contact lens was produced by cutting / polish processing from the polymer furthermore obtained, and chemical resistance was evaluated. The obtained result is shown in Table 2.

[0044]

[Formula 16]



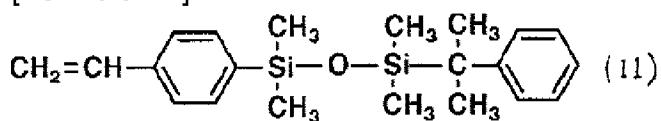
[0045]

[Work example 3] Ten copies of silicon content styrene expressed with the following type (11), 40 copies of silicone system macromere expressed with a general formula (9) (Mn2000), Make it be the same as that of a work example 1 except having used 40 copies of hexafluoro isopropyl methacrylate (following 6FM), ten copies of MMA(s), five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The transparent polymer was obtained. About the obtained copolymer, the result of having measured physical properties is also shown in Table 1.

[0046] The contact lens was produced by cutting / polish processing from the polymer furthermore obtained, and chemical resistance was evaluated. The obtained result is shown in Table 2.

[0047]

[Formula 17]



[0048]

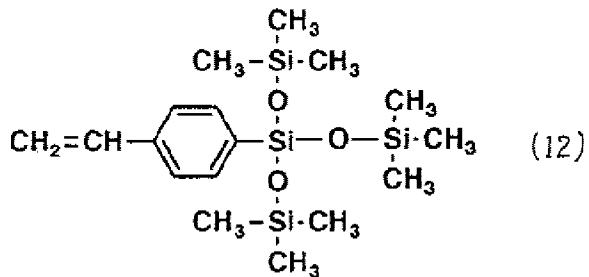
[Work example 4] The transparent polymer was obtained like the work example 1 except

having used 20 copies of silicon content styrene expressed with the following type (12), 30 copies of silicone system macromere (Mn6000) which appears in a general formula (9), 50 copies of 3FM, five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. About the obtained copolymer, the result of having measured physical properties is also shown in Table 1.

[0049] The contact lens was produced by cutting / polish processing from the polymer furthermore obtained, and chemical resistance was evaluated. The obtained result is shown in Table 2.

[0050]

[Formula 18]



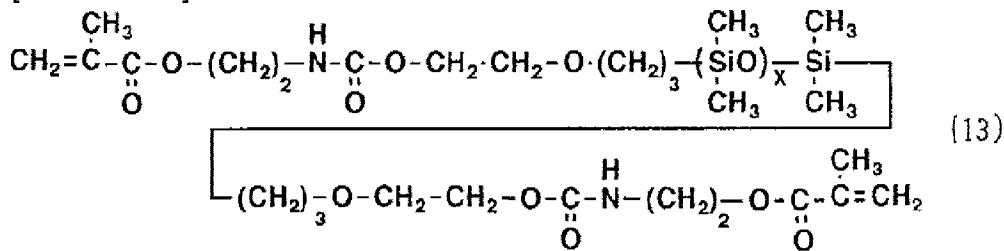
[0051]

[Work example 5] Make it be the same as that of a work example 1 except having used 20 copies of silicon content styrene expressed with a general formula (10), 30 copies of silicone system macromere (Mn4500) expressed with the following formula (13), 40 copies of 3FM, ten copies of MMA(s), five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The transparent polymer was obtained. About the obtained copolymer, the result of having measured physical properties is shown in Table 1.

[0052] The contact lens was produced by cutting / polish processing from the polymer furthermore obtained, and chemical resistance was evaluated. The obtained result is shown in Table 2.

[0053]

[Formula 19]



[0054]

[Comparative example 1] The polymer was obtained like the work example 1 except having

used 30 copies of silicone system macromere (Mn4000) expressed with a general formula (9), 50 copies of 3FM, 20 copies of MMA(s), five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The result of having measured physical properties is shown in Table 1. The obtained copolymer is assuming nebula and does not bear use as a lens.

[0055]

[Comparative example 2] Make it be the same as that of a work example 1 except having used 20 copies of silicon content styrene and 30 copies of tris (trimethylsiloxy) silyl propyl methacrylate which are expressed with a general formula (10), 50 copies of 3FM, 20 copies of MMA(s), five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The transparent polymer was obtained. The result of having measured physical properties is shown in Table 1.

[0056] An impact spreads the breakage situation by the falling ball impact test of the copolymer obtained by this comparative example centering on an impact point, a crack runs the portion radiately as a center, and it breaks. Moreover, the obtained copolymer has a remarkably high ethanol swelling rate, and a chemical-resistant low thing is expected from this. The contact lens was produced by cutting / polish processing from the polymer furthermore obtained, and chemical resistance was evaluated. The obtained result is shown in Table 2. It turns out that the chemical resistance of the obtained lens is lower than this.

[0057]

[Comparative example 3] The polymer was obtained like the work example 1 except having used 20 copies of silicon content styrene expressed with a general formula (8), 30 copies of silicone system macromere (Mn3200) expressed with a general formula (9), 50 copies of MMA(s), five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The result of having measured physical properties is shown in Table 1.

[0058] The obtained copolymer is assuming nebula and does not bear use as a lens.

[0059]

[Comparative example 4] The polymer was obtained like the work example 1 except having used 30 copies of silicone system macromere (Mn6000) expressed with a general formula (9), 70 copies of 3FM, five copies of MAA(s), five copies of ED(s), and one copy of benzyl dimethyl ketal. The result of having measured physical properties is shown in Table 1. The obtained copolymer is assuming nebula and does not bear use as a lens.

[0060]

[Table 1]

	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5	比較例 1	比較例 2	比較例 3	比較例 4
酸素透過性 ($10^{-11} \text{ cm}^2 \text{ sec mmHg}$)	4.8	5.0	5.5	6.5	6.0	4.0	3.0	2.0	6.0
E t O H膨潤率 (%)	3.7	3.4	3.6	3.2	3.8	3.5	1.25	3.1	3.2
ビックカース硬度 (Hv)	5.1	4.8	5.2	4.5	5.2	3.8	6.0	4.1	3.5
落球試験 (cm)	6.0	5.5	5.5	5.5	6.5	5.5	4.0	5.5	5.5
加工性： 切削 研磨	A A	A A	A A	A A	A A	C C	A A	C C	C C
外観	透明	透明	透明	透明	透明	白濁	透明	白濁	白濁

[0061]

[Table 2]

	30分後 (mm)	5日後 (mm)	6ヶ月後 (mm)
PMMA	-0.01	+0.04	+0.07
実施例 1	+0.06	+0.08	+0.08
実施例 2	+0.03	+0.05	+0.07
実施例 3	+0.04	+0.07	+0.08
実施例 4	+0.04	+0.06	+0.07
実施例 5	+0.08	+0.08	+0.08
比較例 2	+0.13	+0.78	結像得られず

[0062]

[Effect of the Invention] The ophthalmic lens material of this invention has the feature which does not break easily even if oxygen permeability and workability are good, and are excellent in chemical resistance and are shocked, and cannot be influenced further easily by the external factor of eye drops, cosmetics, etc. Therefore, the material manufactured by this invention is suitable for charges of eye material, such as a contact lens and an intraocular lens.

[Translation done.]